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Animal Keepers' Forum

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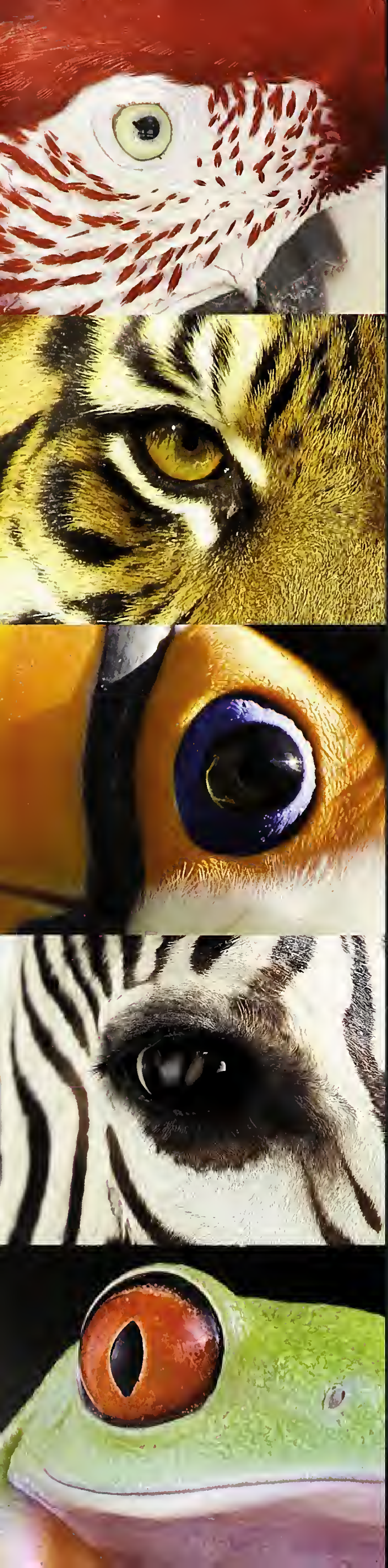

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AMERICAN ASSOCIATION of ZOO KEEPERS

MISSION STATEMENT

American Association of Zoo Keepers, Inc.

The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

About the Cover

This month's photograph was taken by Mehgan Murphy, photographer for the Smithsonian's National Zoo and depicts a male brown kiwi chick (*Apteryx mantelli*). "Pip" hatched on March 7, 2012 and is 24-days-old when this photograph was taken. Both male and female kiwi look exactly alike for the first several years of their life and then the female will gradually become about 20% larger than the male. Kiwi are the slowest growing birds, males take 2-3 years to mature and females 3-5 years. Fortunately we now can take a drop of blood from the egg after hatching and sex them by DNA.

Pip is the sixth kiwi to hatch at the Smithsonian's National Zoo from a wild caught male "Maori" (28-years-old) and a San Diego hatched female "Nessus" (16-years-old). Researchers believe kiwi should have a life span in the wild of 40 to 60-years-old, sadly in some areas they will only reach about 15 years of age due to dogs. There are five species of kiwi but only the brown kiwi (North Island) is exhibited outside of New Zealand.

Pip is the Ambassador kiwi for the zoo; this year is our 26th year of our Meet-A-Kiwi educational program for the public. This is the only type of educational program featuring a kiwi outside of New Zealand. Pip is a very calm and sweet bird, who loves to have his head scratched much like a cat or dog does. For the first eight days after his hatch he liked to go to sleep in the keeper's hands and would flop over on his back to do it.

Articles sent to ***Animal Keepers' Forum*** will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for ***AKF***. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month. Dedicated issues may have separate deadline dates and will be noted by the Editor.

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ANIMAL KEEPERS' FORUM

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FROM THE PRESIDENT

Bugs are awesome. Bugs are great. I love bugs! Words you do not hear the typical zoo visitor saying. We call them invertebrates, and they are great! I am grateful I have had the opportunity to care for a few fascinating species including Vietnamese walking sticks, Hentz striped scorpion and Asian giant centipede. With summer upon us, I encourage you to include information about invertebrates in your conversations with visitors.

Invertebrates are the "backbone" of the world and many species are threatened. Growing up, I remember seeing butterflies all summer long. The monarch butterfly population has declined 90% in recent years. Encourage visitors to add groupings of native flowering plants or window boxes to their homes. Pollinator week is June 20-26 this year. It is one of the many opportunities you can use to engage young visitors. The website pollinator.org has some great information to share!

Encourage people to reduce their pesticide use. Share with them that they can only spray around the foundation, rather than blanket the yard or simply spot treat inside or do catch and release. Help them understand their yard is part of the Earth's ecosystem. Anything they use may make its way into the environment. Protecting invertebrates is very important. Did you know researchers are studying venom from bees, scorpions, spiders and snakes to treat cancer, Alzheimer's and Parkinson's, muscular dystrophy, chronic pain and heart disease?

AAZK's Mission Statement includes promoting the preservation of our natural resources and animal life. I hope you will use this reminder to encourage visitors to do so and as an opportunity for yourself as well.

I would also like to thank Wendy Lenhart for her contributions and participation on the AAZK Board as she moves forward to other endeavors. She helped shape the Conservation Committee and more recently Awards, Grants and the National Zoo Keeper Week program as a Board Member. She still plans to be an active AAZK Member. Best wishes Wendy!

Penny Jolly

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COMING EVENTS

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August 1-4, 2016
14th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles
New Orleans, LA
For more information go to:
turtlesurvival.org/conference

August 15-17, 2016
ZAA Mid-Year Conference
Providence, RI
Hosted by Southwick's Zoo
For more information go to:
zaa.org/conference/mid-year-meetings

August 16-19, 2016
2016 Orangutan SSP Husbandry Workshop and Course
Madison, WI
Hosted by Henry Vilas Zoo
For more information go to:
orangutanssp.org/2016-workshop.html

August 18-20, 2016
Chimpanzees in Context
Chicago, IL
Hosted by Lincoln Park Zoo
For more information go to:
chimpsymposium.org
Will precede the joint International Primatological Society congress and American Society of Primatologists meeting also at Lincoln Park Zoo.

September 7-11, 2016
AZA National Conference
San Diego, CA
Hosted by San Diego Zoo Global and SeaWorld San Diego
For more information go to:
aza.org/annualconference

September 25-30, 2016
International Aquarium Congress
Vancouver, BC
Hosted by The Vancouver Aquarium Marine Science Centre
For more information go to:
iac2016.venuewest.com

October 1-5, 2016
Otter Keeper Workshop
Buffalo, NY
Hosted by the Buffalo Zoo
For more information go to:
otterkeeperworkshop.org

October 6-9, 2016
Advancing Bear Care 2016
Omaha, NE
Hosted by Omaha's Henry Doorly Zoo & Aquarium
For more information go to:
www.bearcaregroup.org

October 31 - Nov. 5, 2016
2016 International Gorilla Workshop
Guadalajara, Mexico
Hosted by the Guadalajara Zoo
For more information go to:
igw2016.wordpress.com

AMERICAN ASSOCIATION of ZOO KEEPERS

September 19-23, 2016
AAZK National Conference
Memphis, TN

Hosted by Memphis Zoo AAZK Chapter and Memphis Zoo.

MemphisZoo.org/AAZK-Conference

November 14-18, 2016
15th International Elephant & Rhino Conservation and Research Symposium
Singapore Zoo.
Hosted by Wildlife Reserves Singapore.
For more information go to:
elephantconservation.org

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August 15th & 16th

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August 17th

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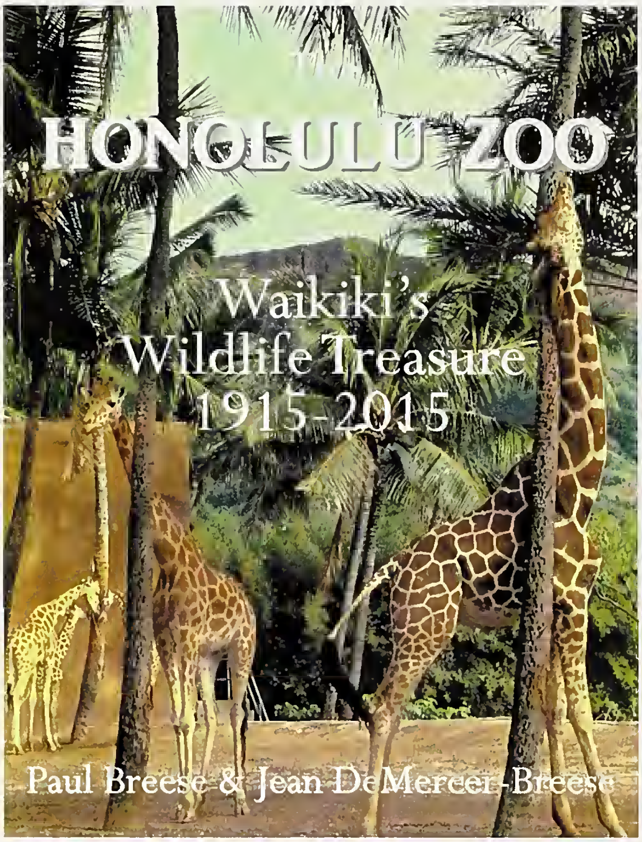
The Honolulu Zoo: Waikiki's Wildlife Treasure 1915-2015

By Paul Breese and Jean DeMercer Breese
Published by Honolulu Zoo Books

Review by Phil King

Retired Foreman/Curator, Assiniboine Park Zoo
Winnipeg, Manitoba, Canada



I first met Paul Breese and his charming wife Jean on a visit with my wife to the Hawaiian Islands in 1991. I had heard of Paul of course, but never hoped I would have the privilege to (meet him). Predictably, we talked long and at some depth about Paul's history, where he regaled us with stories about his involvement with so many wildlife projects that it required a second meeting in order to take it all in. Our second meeting was at the Honolulu Zoo, and after going through the zoo with Paul, sat at a picnic table in the parkland outside the main entrance (likely the same one that he used as a meeting place when he worked there – and which is referred to in the book) where amongst other things he explained the similarities, architecturally speaking, between the zoo entrance and the U.S.S. Arizona Memorial at Pearl Harbor.

During our two meetings I learned of his involvement in making the Hawaiian Goose or Ne-Ne the official state bird of Hawaii; of his work with preventative and control measures to prevent the Brown Tree Snake from reaching Hawaii and wreaking the same kind of damage as it has on Guam and other places; of shipping Giraffes to the island of Molokai by barge; of helping to introduce the Cattle Egret to the Hawaiian Islands for fly control; of his assisting and supporting the concept of displaying and managing exotic birds in hotel grounds (supported of course by qualified staff); and his undying love of and for, and commitment to the natural world in a realistic and almost avuncular sense. Then came his expressions of pride in such remarkable feats of animal husbandry as breeding Cassowaries for the first time in recent history, and certainly the first time in an American zoo; the first captive breeding of Galapagos Tortoises; success with Manchurian Cranes, and beginning the process for the zoo's remarkable success with Birds of Paradise. Never, during each topic, did he claim credit for these, and so many other noteworthy events; credit always went to the staff and to all others involved. This book is a masterpiece – well-written, well-illustrated, very grammatical and so easy to read. It goes into all the necessary details, and is as interesting to the zoo person (professional, enthusiast, or just interested bystander) as it is to a more general audience.

It will be seen from this book that the Honolulu Zoo ranks highly amongst the best of American zoos, and is in no way a 'bit player'. The zoo began, as did many from that time, as a small collection of animals acquired from various sources, but thought so little of by the city of Honolulu that no detailed records of any kind of these early days are known to exist. An elephant arrived in 1916, and from then on certain animals were brought in and parks personnel were assigned to care for them. It is thought that the animals were as well looked after as was possible for the time, and then, after a series of events, including the unfortunate death of a keeper, followed by the death of the elephant itself, E.H. Lewis, who had established the large avian collection, the Catalina Bird Park, on the estate of the chewing gum magnate William Wrigley on Catalina Island in California, was encouraged to bring his collection to Hawaii and establish the Waikiki Bird Park due to Wrigley's death in 1932. From all accounts this was a magnificent ornithological collection.

The bird park transformed back into the zoo soon after the war and interest arose locally to re-establish the zoo. Here begins the involvement of Paul Breese, who relocated to Hawaii after his wartime service in the U.S. Navy. His previous training at the San Diego Zoo as well as a great interest in animals from a very young age stood him in very good stead. He was determined to be involved, and thus begins the biographical element of this book, because it is almost as much Paul's story as the zoo's, so inseparably intertwined were they.

Several points jump out at the reader, particularly that this book is a vivid reflection of a time in zoo management and operation which is gone forever and is in great danger of being forgotten. It should not be, of course, and this book is replete with references to zoo and other personnel, reference to whom should be required reading to those recent inductees into this wonderful but oh-so changed world in which we have chosen to become involved. To mention just a few, in no particular order – Ellis Joseph, Louis Goebel, Roger Conant, George Munro, K.C. Lint, George Vierheller, Marlin Perkins, Sir Peter Scott, Sir Edward Hallstrom – the list goes on as an authoritative list of the zoo figures and personalities of the day. I know it has become fashionable today to ignore the activities of such early members of the zoo fraternity but it must be remembered that without these early pioneers – and I use that word not for effect but as a statement of fact – today's zoo staffs would have a much harder time breaking the untrodden ground that these people had to – there were no footsteps, in many cases, for them to use as a path. The name of Paul Breese should be included in this list.

Other points of interest are some references to comparisons to the past – 'construction projects were usually far simpler than now', and his description of zoo planner Ralph Virden as 'a rare combination of skills as a zoo designer and builder, along with many years of hands-on experience with zoo animals'. References to zoo curators jealously guarding their 'trade secrets' are the sorts of behaviors that were very common in 'the old days', and having joined the profession as I did at around that time, I can attest that things such as this were commonplace. Remember that there was no *International Zoo Yearbook* in Breese's time, no *International Zoo News*, and membership in zoo organizations and meeting appropriate stands was purely voluntary. Inter-zoo communication was not common and was much more on a personal basis. Directors and other zoo personnel had to be ingenious, creative, full of initiative and not afraid to use it. In those very different times it was expected that in many cases zoo directors worked their way up from keeper positions, or arrived with varied animal experience. The gestation period of zoo directors being purely administrators had not yet begun. Often overlooked too, is the aspect of acquiring animals for zoos. A large percentage of them were wild-caught animals captured by animal collectors, and while we might find some aspects of this somewhat distasteful, we must also remember that it was, at the time, the only way that new specimens could be obtained, in many cases. Let us not forget that those wild-caught animals became the basis, in so many ways, of the opportunities to develop the necessary skills to properly maintain some of these species, and consequently, their future. In addition to all this 'trailblazing' it should not be forgotten that the islands of the Hawaiian chain, of which Honolulu is the capital, are amongst the most isolated in the world. There is nowhere where you can go for a quick visit to exchange ideas or gain ideas and this isolation adds enormously to the challenge of building a major zoo. I remember discovering evidence of this little-known skill; the need to develop and use – more out of necessity than by choice – a good level of initiative to counteract the lack of immediately-available resources. It was common in Australia and New Zealand for much the same reasons, and in those days Honolulu was pretty much in the same boat; not a challenge for just anybody to take on; the zoo director had better be ready and resourceful.

This book is copiously illustrated with photographs, drawings, newspaper articles, and cartoons. It has a well-planned index of topics, names, and notable events referred to in the text. Also present is a thorough index listing the source and origin of each photograph and illustration. This book is an incredibly well-written and masterful reflection of how the zoo world used to be, and should be of interest to anyone interested in the culture and history of our chosen line of interest, whether it be from the perspective of an interested person with a thirst for knowledge about the subject that bonds us together, or the zoo professional, whether still active or not, especially those arriving newly into the field. Collectively, you need to know how things were, from someone who has spent his professional career involved in it. New keepers should read this and learn. Interested persons will not find a more thorough but blissfully easy to read and learn from publication. Established professionals will perhaps be surprised how much you knew and have possibly forgotten. I can't remember having so much fun since I read the autobiographical 'A Field Guide to the Life and Times of Roger Conant'.

As a friend of the Breese's of course I am somewhat biased, but at the same time feel especially privileged to write this review of one of the most fascinating such books I have come across in a long time. The best way I can sum up is to salute Paul as did Cynthia Eyre in local magazine 'The Beacon' in June 1964 by describing him as "the talkative and in-love-with-life-and-all-its-manifestations zoo director. Pick up a copy – you won't regret it.

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If the Shoe Fits...An in-depth look at a common zebra's hoof injury repaired via corrective shoeing

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Introduction

In March of 2013 Disney's Animal Kingdom (DAK) was home to 0.1 common zebra (*Equus burchelli*) "Mama". Mama sustained an injury shortly after recovering from an immobilization, which caused her right rear hoof to fold forward. Knuckling over on to the coronary band caused significant damage to the tendons and ligaments in the leg. Keepers, managers, veterinarians, and specialists collaborated to formulate a treatment and husbandry plan for Mama. Over the next six months, she was immobilized seven times, was under the care of a farrier who created specialized shoes for her, and underwent multiple radiographs, ultrasounds, shockwave therapy, footbaths and physical therapy. While the treatment and husbandry plans were extensive, Mama was able to recover to a nearly "normal" gait. This allowed her to be relocated to a new facility in northern Florida with her herd mates in March of 2014. Throughout this paper we will detail the specialized husbandry provided by keeper staff, the custom shoes created for her and the excellent veterinary care she received.

History

Mama was a 12-year-old mare at the time of the injury. She came to DAK in February 2012 along with 0.5 common zebra. They were later housed with an additional 0.6 common zebra. The herd was housed in a 2.5 acre holding pen that was comprised of grass, sand, and trees. It had sloped sides leading into grassy moats. Small holding stalls, 900sqft, were used for feeding, separating, and medical procedures. These stalls consisted of chain link walls, soil cement flooring, and a tarp structure covering approximately 1/3 of the stall.

Mama was neither the most dominant nor the most subordinate zebra in the social hierarchy of the herd and appeared to be pair bonded with a 3-year-old mare, "Tiny". During the six months Mama was under specialized care, she and Tiny were separated from the herd. They were held in the holding stalls described above and in two stalls that consisted of wooden walls and soil cement flooring. A grassy yard was also utilized at times. Separation from the herd enabled keepers to more closely monitor her progress, as well as provide her with a firm substrate to aid her recovery.

Timeline

On March 14, 2013, Mama was chemically immobilized and some light hoof work was performed. Her immobilization and recovery were uneventful. The day following the immobilization, Mama and Tiny were reunited with their herd in the 2.5 acre holding pen. Later that day keepers observed Mama stumble on her right rear hoof and then drag the tip of the hoof on the ground. The next day, her lameness became even more severe. While walking, she allowed her foot to roll over and would take several steps on the coronary band before righting it. This was observed repeatedly throughout the day lasting for five to ten steps per episode. Keepers noted that the episodes appeared exacerbated by soft or sandy substrate. In order to prevent Mama's condition from deteriorating further, animal care staff attempted to shift her into a different holding area that afternoon. However, the stress of trying to separate her from the recently reunited herd in such a large space proved to be too much and the attempts were unsuccessful.

The following morning while shifting for grain, Mama and Tiny were separated from the herd and housed in the holding stalls described above. DAK veterinary staff visually examined her and recommended housing her on a flat surface until further notice. Mama and Tiny were transferred from the temporary holding stall to a barn with soil cement and grassy yard options. A day later, they were given access to the grassy yard, hoping it would be a better surface for her injury. However, Mama's right rear hoof caught on the grass and uneven surface, causing her hoof to knuckle under several times. She was returned to the soil cement yards after approximately two hours of no improvement. Management decided to house her in a single 820sqft yard to restrict her activity. Mama was then prescribed her first round of oral pain medication. She remained on either Banamine® or Phenylbutazone paste, both non-steroidal anti-inflammatory drugs, for the entirety of her healing process in an effort to reduce inflammation and provide pain relief.

Within five days of starting the medication and being housed on a hard surface, Mama's gait had improved. Her right rear hoof was knuckling under much less frequently, but was only showing a slight limp. Veterinary staff visually examined her and video documentation was subsequently sent to large animal surgical experts at the University of Florida for consultation. It was determined that Mama had most likely sustained nerve damage that would heal over time and to take a 'wait and watch approach'. The recommendation was to continue housing Mama at the barn and to give her access to a second yard, thus doubling her housing space, provided her gait did not worsen. After a week of increased space, Mama's gait had continued to improve and veterinary and animal care staff were comfortable introducing her to the grassy yard to evaluate her ability to ambulate on an uneven surface. Mama and Tiny were then allowed access to the grassy yard. While walking, Mama was observed to shuffle her right rear leg and knuckle under on to the fetlock throughout the day. As a result, the affected fetlock became inflamed and the two were shifted back to the harder surface. Two days later, chips and cracks on the lateral side of the right rear hoof were noted, and inflammation of the coronary band was evident. There were also a few scrapes present on the hock.

After one week with no improvement, Mama was immobilized for a physical examination and radiographs of her right rear leg. A hoof wall abscess was discovered below the coronary band on the lateral side of the hoof. The abscess was addressed by a zoological manager trained in hoof work and antibiotics were administered. Veterinary staff recommended treating the abscess with a footbath twice a day. Once Mama had recovered from the immobilization, she and Tiny were given access to a hallway that ran along their yards in order to desensitize them to the hallway and initiate footbath training. Four days later, Mama was immobilized again for additional hoof work, however this time by a farrier. A custom shoe was fashioned for her right rear hoof and applied with a strong epoxy. This shoe was designed to remove pressure from the abscessed area and distribute Mama's weight evenly throughout the foot (See Figure 1). Synthetic polyurethane shoes were applied to the other three hooves for protection from the hard surface (See Figure 2). The following day, Mama started a 20-day footbath regimen with a diluted Nolvasan® solution and she entered the footbath twice per day (See Figure 3).

On May 11, 2013, about two months after the initial injury, Mama was immobilized again. This procedure included the farrier and DAK veterinarians. An ultrasound and additional radiographs of the injured hoof indicated excess fluid around the tendons between the fetlock and coronary band. The footbath was no longer deemed necessary, but due to the fluid in the joint, hydrotherapy was recommended. The farrier removed all four shoes and replaced them with basic polyurethane shoes. Following the immobilization, keeper staff began to desensitize Mama to a hose for hydrotherapy. The veterinarian recommended using a hose to spray down Mama's hoof twice daily for about 10 minutes per session. Mama was fed moistened beet pulp out of a bowl while keepers ran a hose onto the ground that drained onto her feet. This process was relatively successful in that she became desensitized to the running water. The hydrotherapy overall was never able to be fully implemented, as keepers were not able to apply a pressurized stream of water onto the affected area. Mama and Tiny were then given access to the grassy yard to test Mama's gait on uneven surfaces and allow their hooves and joints reprieve from the hard surface. This time Mama was able to navigate the softer surface without incident.

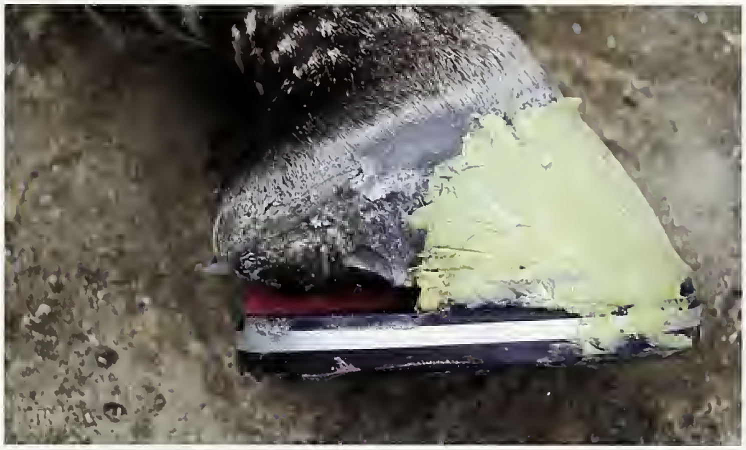
Figure 1. Customized pressure relieving shoe adhered to Mama's foot with epoxy. This photo was taken in a backstage area.

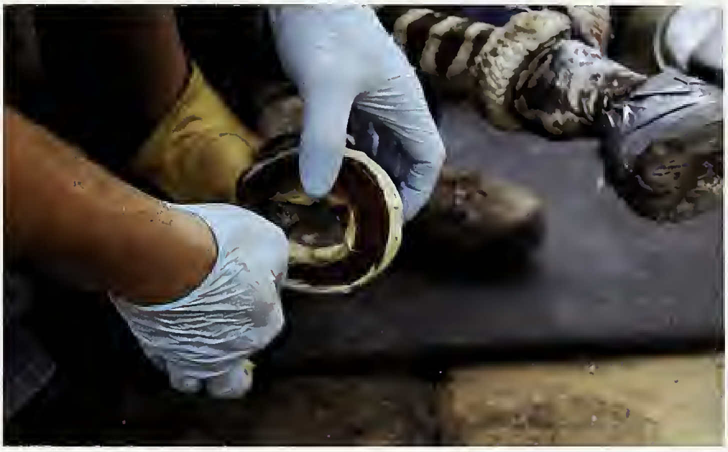
Figure 2. Synthetic polyurethane shoes for hoof protection. This photo was taken in a backstage area.

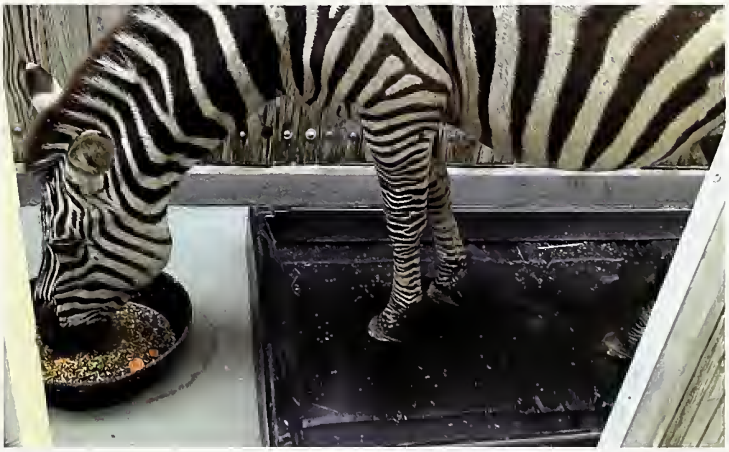
Figure 3. Mama standing in footbath. This photo was taken in a backstage area.

Figure 4. Mama and Tiny in the 2.5 acre holding pen prior to joining their conspecifics. This photo was taken in a backstage area.

Within twenty days of the May 11 immobilization, keepers noted a strong odor emanating from Mama. She was immobilized on June 5, by DAK veterinarians and University of Florida veterinarians. The source of the odor was never identified, but veterinary collaboration determined ligaments on the outer side of the fetlock and those connecting the fetlock to the pastern were enlarged to 2.5 times beyond what is normal. At diagnosis, hyaluronic acid and steroids were injected into the tendon and fetlock areas to reduce inflammation and lubricate the joint. Exercise therapy was also recommended for 10-20 minutes twice daily.

On June 9, Mama and Tiny started exercise therapy. Keepers began with A to B training by calling Mama to walk in an L pattern from one end of the grassy yard to a door at the bottom of a soil cement yard. She was rewarded with a mixture of beet pulp and sweet feed. Mama did not consistently participate in the training, but she still exercised by walking around the two yards. The initial session lasted 15 minutes, and Mama walked approximately half of the time. Tiny was allowed access, but decided not to participate in the training session. Two days later, management allowed Mama to have a larger area for exercise. Keepers encouraged Mama to walk into a wide, dirt corridor by placing bowls containing a few bites of beet pulp and sweet feed in several sequential locations. The corridor was approximately 213 feet in length and 11 feet wide. Tiny was also allowed access since Mama was unwilling to shift alone. This was done daily with varying success due to many distractions and spooking occurrences. Over the course of a week, Mama and Tiny became accustomed to the training and would venture down the corridor calmly, spending approximately 30 minutes exercising daily.

Exercise therapy was a learning process for the zebra as well as the keepers, but in the end the obstacles were overcome and Mama's therapy was successful.

At the end of June 2013, Mama was immobilized for additional hoof work. The farrier reported the previous abscess site was healed, but the hoof would take 10-12 weeks to re-grow completely. The tendons in Mama's right rear leg were now in need of attention. He constructed a wedge-like shoe that would encourage the muscles and tendons along the anterior and posterior aspects of the canon to stretch and lengthen. A shoe was also applied to the left rear hoof to provide balance when walking and standing. The existing exercise program of 30 minutes a day was continued.

At the beginning of August 2013, Mama was immobilized for a physical examination and hoof work. Basic polyurethane shoes were applied to all four feet by the farrier. The ligaments in the right rear leg were palpated and evaluated via ultrasound by DAK veterinarians as well as an equine lameness and imaging specialist from the University of Florida. Additionally, shockwave therapy was administered to the area. In horses, shockwave therapy is used for the treatment of musculoskeletal soft tissue pain and disorders. Sessions provide relief of acute and chronic pain. Equine shockwave therapy also restores mobility and promotes faster healing by stimulating bone growth, tissue regeneration and the release of endorphins.[1] The veterinary team gave approval for a larger exercise space. After being housed at the barn on soil cement with a sod yard, Mama and Tiny were introduced to a large, gradually sloped pen at the end of the corridor, known as the catch pen. The pen had an average gradient of approximately 8% (or 4 degrees.). Mama appeared to have difficulty navigating this incline and began favoring the left rear leg. Despite pain medication, Mama continued to struggle walking up the hill, but did not while walking on flat surfaces. Two weeks after being introduced to the catch pen, Mama was still showing effort while walking, but had improved. Mama did not return to her original gait, but had reached a new "normal"gait. She received her last dose of pain medication on August 20, 2013 five months after the initial medication course was implemented. Three weeks later, keepers found the remnants of Mama's polyurethane shoes in the catch pen. On September 28, Mama was immobilized a seventh time. An ultrasound was performed and the right rear coronary band appeared healed. The farrier was satisfied with the state of the hooves and Mama was fully medically resolved just over six months after the initial injury. The farrier's examination, as well as ultrasound imaging reported that Mama would still have some swelling in her ligaments as well as scar tissue. Her right rear leg would also suffer from 'long term fetlock contracture,' or permanent shortening of the muscles and the joint.

Mama and Tiny remained in their catch pen for an additional four weeks to allow the tendons and ligaments in Mama's leg to strengthen further. Mama continued to walk with a new "normal" gait, one in which she did not plant the bulb of the right rear hoof as close to the ground as the left rear hoof. On October 29, animal care staff felt Mama had mastered the incline of the catch pen and decided she was ready for the 2.5 acres of sandy, hilly pasture where she had previously lived. Mama and Tiny were moved to this area and housed alone for three weeks prior to reintroductions to the herd (See Figure 4). Seven months after their separation, Mama and Tiny were reunited with two of their herd mates. The zebra approached and greeted one another with a minimal amount of kicking and running. Mama's injury did not appear to recur or hinder her in the introduction to the pen or to the other zebra. Four months later, the four animals were loaded into a trailer and transported to a private facility in northern Florida. Mama and her herd mates are currently part of a larger herd and are housed on many acres of grassy pasture. Animal care staff there has reported that she is doing well and her hoof issues have not recurred.

Challenges

Throughout the course of Mama's treatment, keepers were faced with medical, facility and husbandry challenges. Hydrotherapy was an ineffective treatment option for Mama. She would allow the water to spray up on to her feet from the hard surface she was standing on, but would not allow a pressurized stream of water to be applied to her hoof. The goal of hydrotherapy was to reduce inflammation via concentrated water application. Since this was never achieved, hydrotherapy was unsuccessful.

When Mama began exercise therapy in the corridor, the team was faced with several husbandry challenges. The corridor leads to large pens that house multiple different species. The animals housed in these pens, Grevy's zebra in particular, became a distraction to Mama and Tiny as they then shared a fenceline. Keepers would feed the Grevy's away from the shared fenceline in order to encourage them away from this space. The vocalizations from the wattled cranes in the pens initially spooked them, but the zebra quickly became desensitized. The corridor was not covered and therefore storm clouds, rain, and lightning would also cause issues. This was easily dealt with as keepers could adjust the times in which the animals had access to the corridor. Exercise therapy was a learning process for the zebra as well as the keepers, but in the end the obstacles were overcome and Mama's therapy was successful. The other challenge faced was the wearing down of Mama's hooves from constant housing on a hard surface. The farrier applied shoes to the uninjured hooves in order to relieve pressure and reduce wearing of the feet. Rubber mats were placed throughout the yards in order to provide stable but softer places to stand and walk.

Conclusions

Although lengthy, Mama's recovery was ultimately successful, much due to the diligent teamwork of the veterinarians, keepers, managers, and farrier. Each was willing to go above and beyond expectations and demonstrated patience and adaptability throughout the entirety of her recovery. Daily observations and communication were critical components of keeping the team focused and moving forward. Keepers recorded her progress in the Daily Report System and kept a separate, husbandry-oriented notebook to aid in determining best practices amongst keeper staff. Disney's Animal Kingdom has abundant resources and professional contacts and in this particular case, veterinary specialists at the University of Florida and a skilled farrier partner were utilized. These networks, however, are not unique to this institution. It is possible for many zoos to collaborate with outside partners in order to provide excellent care for the animals in their collections. Hopefully this paper provides useful information, tools and ideas for navigating through a complex situation such as this, and the potentials and benefits of professional partnerships.

Acknowledgements

We would like to thank Disney's Animal Kingdom veterinarians, especially Dr. Natalie Hall and Dr. Diedre Fontenot who were the point veterinarians on the case, the University of Florida veterinarians that consulted on Mama's case, and the farrier Adam Whitehead. We would also like to thank the West Savannah animal care staff for the excellent husbandry care they provided Mama and for their support while writing this paper. Thank you to Hilarie Weiland for photographically documenting the procedures and contributing photos of Mama's hooves to this paper. Many thanks go to the West Savannah zoological managers: Karen Jasmin, Gary Noble, Jen Windau, Robyn Johnson and Steve Castillo for their support and guidance. And last but not least, we would like to thank Dr. Jill Mellen, Education and Science Director at Disney's Animal Kingdom and her staff for reviewing this paper.

Citations

[1] Extracorporeal Shock Wave Therapy (ESWT) For Horse, *FOCUS-IT Your Specialist for Shockwave Therapy & Innovative Technologies*, http://eswt.net/equine, (June 8, 2015)

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Abyssinian Ground Hornbill Breeding at Disney's Animal Kingdom Lodge: Finding a suitable alternative to hand-rearing second chicks

Mel Covey, Animal Keeper
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Lake Buena Vista, FL

Abyssinian ground hornbills (*Bucorvus abyssinicus*) (AGHs) have been residents of Disney's Animal Kingdom Lodge (DAKL) in Lake Buena Vista, FL since the year it opened in 2001. They have shown off their collected treasures and delighted guests with their vibrant personalities for many years. Within the last five years they have also become integral members of the AGH breeding population.

AGHs form monogamous pairs that mate for life. In the wild, the female lays two eggs within a 4-6 day period in an empty tree cavity and relies on the male to bring her food during incubation and for the first few weeks after the egg hatches, at which time the female leaves the nest and joins the male in the role of hunting for food. After a 37-41 day incubation the first egg hatches, followed by the second egg 4-6 days later. AGH chicks are competitive and the pair is only able to provide enough food for one chick. The strongest (typically the first and largest chick) out-competes its sibling for food. After several days, the second chick dies due to lack of nourishment. In wild birds the second egg acts as a hornbill insurance policy in case the first egg doesn't hatch or the chick is not strong enough to survive, ensuring that one chick is healthy enough to reach adulthood. After the chick fledges between 80-90 days it remains with the pair learning necessary hunting and survival skills until the next year's breeding season when it is displaced from the group by the parent of its sex. The poor likelihood of survival for the second chick has led many zoos to pull the

Photo 1: Haya with both Chick #1/Hanz (day 6) and Chick #2/Franz (day 1) on 26 June 2014. *Photo by author.*

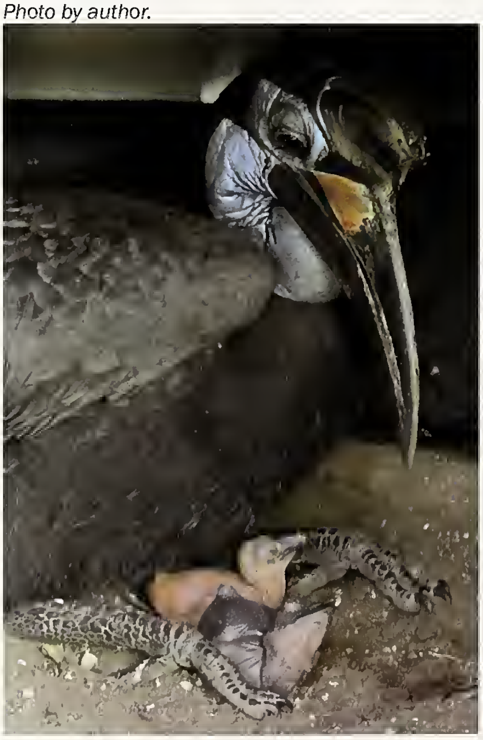
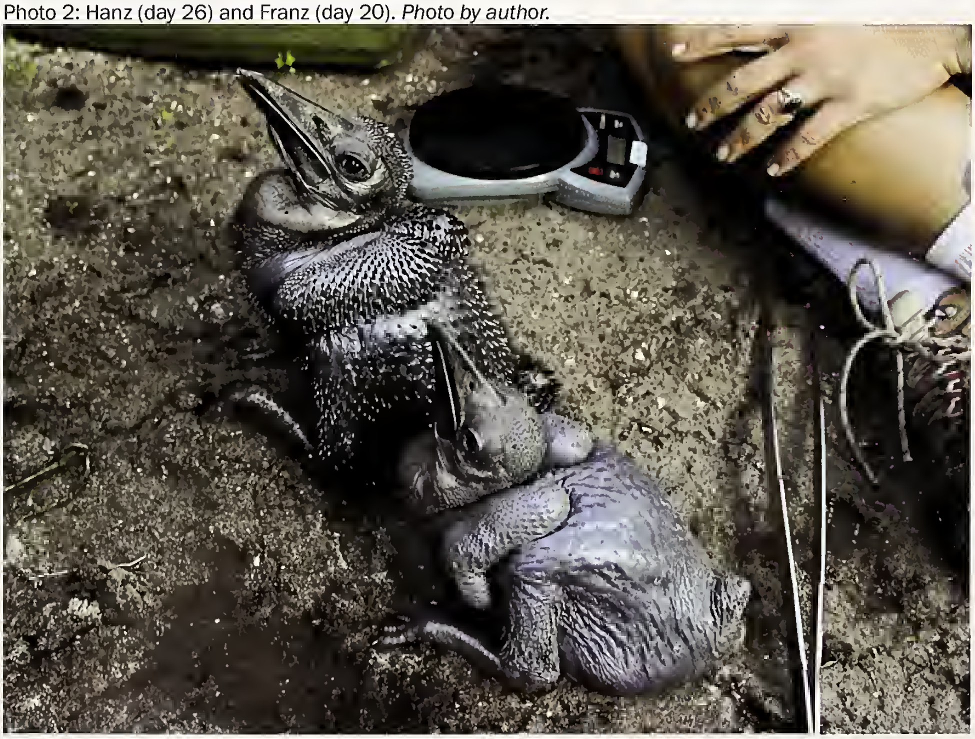


Photo 2: Hanz (day 26) and Franz (day 20). *Photo by author.*



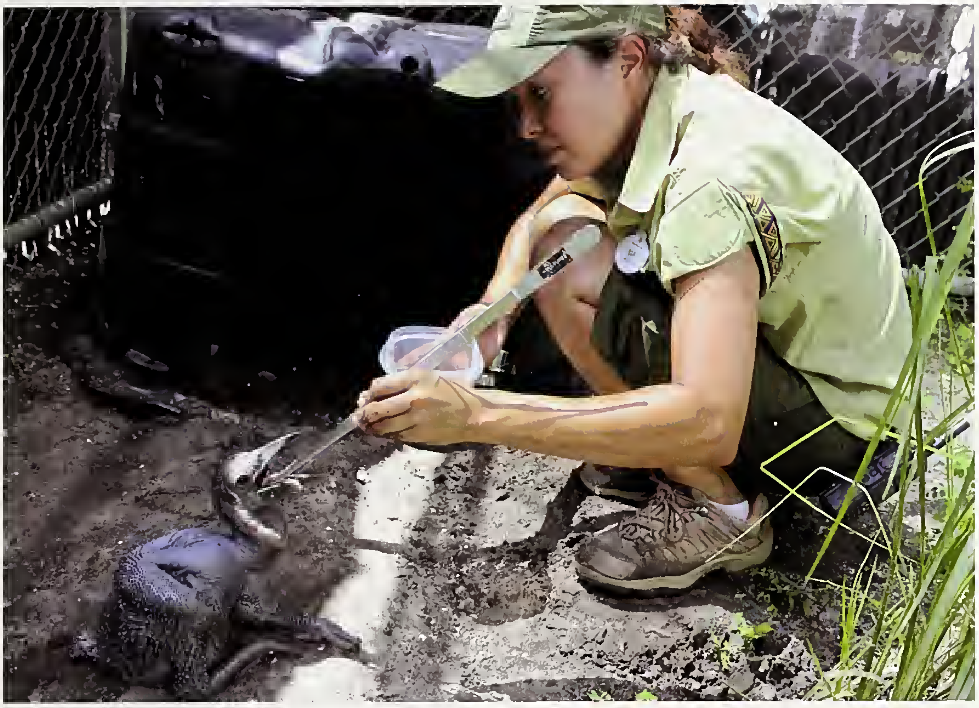


Photo 3: Shows keeper Yari Rodriguez feeding Franz (day 26). *Photo by author.*

First Occurences	#1 "Hanz"	#2 "Franz"
feeding on own	40	34
standing	48	47
walking	61	53
left hut on own	75	74

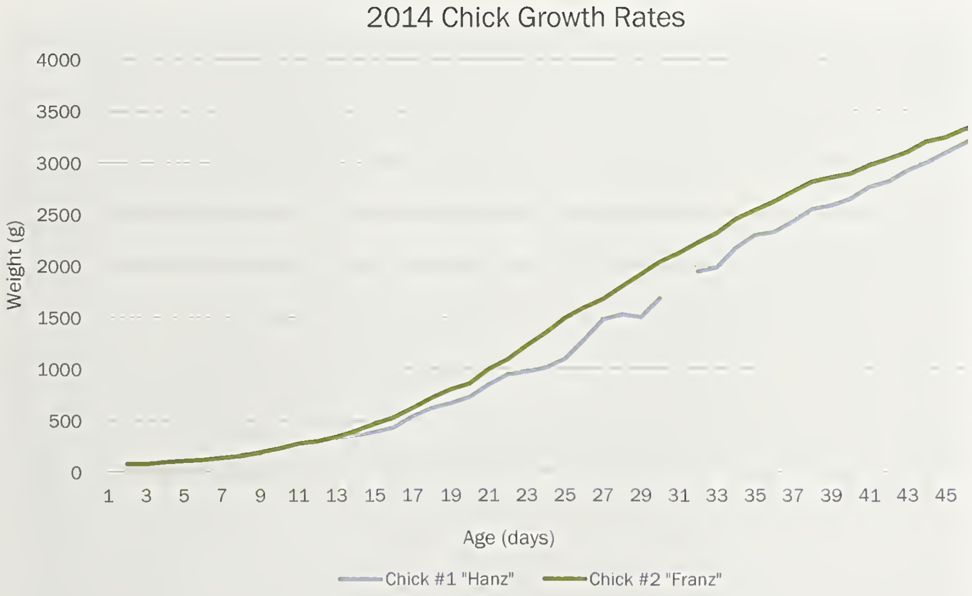
Figure 1: Shows the days that each of the chicks hit different "milestones" in their development

second egg (and many times the first as well) for hand-rearing resulting in an abundance of hand-reared hornbills. As a result of their rearing, hand-reared birds are very drawn to people, appear to be less interested in their hornbill counterparts, and are less likely to breed or show less interest in rearing their chicks.

The current breeding population at DAKL consists of two pairs. Jaseri (hand-raised) and Haya (parent-reared) form the first and most successful breeding pair, while Cassanova (hand-raised) and Taabu (hand-raised) form the second pair that has just begun showing breeding behavior over the last two years. For this paper we will be focusing on Jaseri and Haya.

Jaseri and Haya live on the Pembe savanna, a four acre multi-species enclosure. The species have changed over the years but have most recently included ankole, okapi, nyala, Thomson's gazelle, impala, steenbok, waterbuck, red river hogs, blue cranes, Egyptian geese, and Ruppell's griffon vultures. All of the mammals on the savanna are audibly cued into a barn for about two hours each morning and are given their grain diets before being released back on the savanna for the remaining 22 hours each day. The AGHs have traditionally been indifferent to most of the animal inhabitants on the savanna, but are very drawn to the keepers in the area and often investigate their vehicles and make their own enrichment from any items they opportunistically steal from the vehicles. The hornbills are cued into their own holding pens each morning and again for a few hours in the afternoon to allow keepers the opportunity to work on the savanna "unassisted" by the hornbills. The hornbills receive their diets consisting of ground meat, pinkies, and mice while they are inside their pens. Both Haya and Jaseri have their own adjacent pens complete with netting on top, perching, a variety of assorted enrichment items, and large black plastic tree pots flipped over with holes cut in the side to act as huts/tree cavities. Throughout most of the year, Jaseri spends much of his pen time inside his hut, while Haya traditionally prefers to investigate the enclosure and rest on perching.

On 13 May 2011 broken egg shells were found just outside the hornbill holding pens. They were first believed to have belonged to the Ruppell's griffon vultures who had laid in years past. On 17 May 2011 Haya quickly ran into her hut when cued into holding during the afternoon and an egg was found under her a few hours later. This led the team to believe that the egg laid just days earlier most likely belonged to Haya. To ensure the egg had the best chance of survival, it was pulled for artificial incubation at the Avian Research Center (ARC) located at Disney's Animal Kingdom and replaced with at East African Crowned Crane dummy egg (the closest in size the team had to a hornbill egg). A second egg was laid on 24 May and it was also brought to ARC for incubation and replaced with a dummy. Until this point, Jaseri had been kept separate from Haya as it was unknown how he would react to the eggs. On 26 May keepers allowed him access to Haya in hopes that he would resume his natural role and bring food items to Haya as she remained on the nest. Jaseri quickly decided that the eggs made excellent toys and rolled them out of the nest and paraded them around the holding pen. As a result, he was then separated from Haya. Fortunately, it was easy for the team to play the role of the male and Haya's diet was



placed just inside the hut twice daily and Jaseri returned to his savanna home for the duration of the incubation and chick rearing process.

The second egg at ARC was determined to be infertile, but the first egg progressed and grew as expected. On 24 June 2011 the egg began internally pipping at ARC and it was brought back to Haya and switched out with one of her dummy eggs. On 25 June the chick hatched following a 39 day incubation. This year there was a significant amount of aggression from Haya directed towards keepers as they attempted to place her food just inside the hut. Keepers began entering with a small shield as protection. Observations were limited to what was seen when switching out the diets, which we initially did five times daily, but quickly changed to four times daily due to consumption. The diet was weighed both going in and out of Haya's pen to determine consumption levels and track the chick's progress. A neonate exam was performed on day 3. The chick was given a physical exam, pinioned, an Avid^{TM} chip was placed in the breast, and blood was taken to determine the chick's sex. From this point the team remained hands-off with the chick to limit the chance of impacting Haya.

The goal was to raise a chick that would behave as much like a parent-reared chick as possible by minimizing imprinting from hand-rearing.

On 13 Dec 2011 (day 167) both Haya and the chick, now determined to be female and named Cecelia, were both released onto the Pembe savanna for the first time. On 17 Dec 2011 (day 172) they were introduced to Jaseri with no negative interactions and they remained a family of three until 14 April 2012 when Haya was observed aggressively chasing Cecelia. At this time Cecelia was pulled from the family group and transferred to another pen.

Keepers were aware when Haya began nesting as she spent more and more of her pen time in her hut. She was allowed to remain inside if she desired and for the next two years Haya successfully raised two more chicks, one each year. Alfred hatched on 1 August 2012 and Jolene hatched 14 July 2013. Alfred was able to remain with Jaseri while Haya was sitting and raising Jolene. This was most likely due to Jaseri not chasing off Alfred before breeding season. An attempt was made to introduce Alfred to Jolene when it was time to release her on the savanna. Alfred showed significant aggression towards Jolene and chased her and attempted to pound her with his beak. Haya then retaliated with aggression directed at Alfred. Alfred was pulled on 23 November 2013. Haya removed Jolene from the group on 24 March 2014.

As of the spring of 2014 the team had not needed to worry about a second chick. Haya either laid only one fertile egg or one of the eggs died during incubation each year. On 12 May 2014 Haya laid her first egg of the season and on 17 May she laid her second. It was decided that as an experienced mother, both eggs would remain under Haya for incubation. On 18 June 2014 the first egg began to externally pip and it hatched on 20 June. The second egg began to externally pip on 24 June and hatched on 26 June.

In the days leading up to the second egg hatching, keepers and managers began talking about the likelihood of both eggs hatching (the second egg was candled by Aviary staff shortly before the first egg hatched and it was determined to be fertile and growing) and discussed the options on rearing the second chick. The goal was to raise a chick that would behave as much like a parent-reared chick as possible by minimizing imprinting from hand-rearing. A secondary goal to minimize the labor impact to the keeper workload was also established. The team was well aware of the results of pulling the second chick for hand-rearing. A healthy chick would most likely result, but if the chick was like DAKL's three other hand-raised birds, it would be very people-focused, over-attached to the keeper team, and show little interest in remaining with other hornbills. The team looked back to 2009 when a pair of Ruppell's griffon vultures (*Gyps rueppellii*) at DAKL cared for their chick, but showed no interest in feeding it. The team removed the parents from the nest several times throughout the day and successfully fed the chick with a pair of tongs. After feeding, the sire and dam returned to the nest and both cleaned and protected the chick. The team's success in rearing the vulture chick was initially utilized in the plans for rearing our second hornbill chick. A plan was formulated to feed this hornbill chick with a pair of tongs while Haya was still on the nest. A new nest box was created with additional holes on the side to give keepers additional access points to the nest. By keeping the chick with Haya during the rearing process this allowed it to imprint on her. It was accepted that the chick would probably become more attached to the team and partially imprint, but the hope was that it would also understand that it was a hornbill. This method also appeared to be minimally time invasive so it fit the secondary goal as well. A few days before the second chick hatched keepers switched out the nest box and began acclimating Haya to a pair of tongs with no negative interactions.

Once the second chick hatched, attempts were made to feed it by reaching around Haya with the tongs. Haya was much calmer with

Photo 5: Hanz (day 96) meeting dad, Jaseri for the first time and begging for food. *Photo by author.*

Photo 6: Hanz (day 179) on savanna. *Photo by author.*

the team than she was the first year, but she became very aggressive towards the tongs reaching into her nest at that time. Keepers were able to get a few pieces of food to the second chick the first few days, but it became evident that the chick was not able to get enough food feeding through this method. On day 3 keepers forced Haya out of the nest box and briefly pulled the chick outside the nest box for feeding. It consumed half of its allotment for the feed and was returned. Keepers watched and Haya quickly returned to the nest box to keep her chicks warm. The keeper team observed throughout the day to confirm that Haya was still not feeding the chick and on day 4 this method became the norm. Four times daily, two keepers entered the pen to feed the second chick. At the first feed each day, both chicks were pulled for weighing. The first chick was immediately returned to the nest and the second chick remained out for a keeper to feed it with the tongs. During the feeds, the second keeper kept a visual on Haya and rewarded her with crickets. The goal was to make keepers entering her pen as positive an experience as possible for Haya.

Throughout this time, keepers intermittently set up a Go-Pro® camera to observe Haya and her chicks. The team hoped to observe Haya feeding both chicks. If it could be determined that both chicks were receiving sufficient food from her, the plan was to back off on the feedings of the second chick. Unfortunately, when Haya didn't immediately knock the camera down (cameras are fun toys after all) it was observed that she was exclusively feeding the first chick. However, she remained protective of the second chick and made sure to keep it warm and secure.

The chicks were raised on a similar schedule to the previous chicks. They had their neonate exams 2-3 days after hatching and were fed intermittently throughout the day. Blood DNA results indicated that both chicks were male. Hanz (the first chick) and Franz (the second chick) progressed as chicks had before with the exception that we were more hands-on with these birds due to our hand-feeding of Franz and were able to learn many of their firsts such as when they are able to feed themselves, stand, walk, and when they first leave the nest occurred (Figure 1). The daily weights obtained will hopefully become a valuable tool in future years, but due to past "hands-off" management, we have very limited data from previous years for comparison.

As the chicks grew, Haya began spending more and more time off the nest and exploring her pen. This was normal behavior for her in years past. We eventually gave her access to a larger pen during the day to allow her room to forage and hunt on her own. The chicks first left the hut on their own at 75 days (Hanz) and 74 days (Franz). Their activity levels were low at first, but they were observed gaining strength and spending more time walking as opposed to resting while out in their pen. Jaseri was introduced to the group at 90 days (Franz) with no negative interactions. At this point both Haya and Jaseri were observed feeding whichever chick would approach them and beg for food. On 21 Oct 2014 (day 117 for Franz) all four hornbills were introduced to the Pembe savanna.

One notable difference was observed in both Hanz and Franz which differs from chicks in the past. Once introduced to the savanna, rather than constantly remaining near their parents, they frequently had been observed remaining together, yet apart from Haya and Jaseri. This was most apparent at night when Haya and Jaseri chose to sleep on the ground up against a wall for protection (Haya about 15 feet away from Jaseri) and both Hanz and Franz chose to roost on a piece of deadfall away from the adults. This behavior lasted for the first month that they were on the savanna before both boys began sleeping with Haya as our previous chicks had. They spent more time with the adults than out together, but appeared to be a more independent pair. This is most likely the unusual result of growing up with a sibling. We continue to monitor the boys for any differences observed between them and previous chicks.

At this point in time, both Hanz and Franz appear to be well adjusted hornbills. Hanz began his time on the savanna as a very curious hornbill who was interested in watching the staff, but suddenly took on the behavior of a parent-reared bird and no longer chooses to frequent the areas around the keeper team. Franz picked up where Hanz left off and has become increasingly curious about us. The team has taken steps to ignore his pleas for attention and this approach appears to help to some extent.

On 12 March 2015 aggression was first observed from Haya towards Hanz and Franz. On 28 March the pair was separated from her until she laid eggs inside and was then re-introduced to Jaseri on the savanna with no negative interactions. The team plans on sending them to another facility before Haya and her most recent 0.1 AGH chick, Delilah, are introduced back to the Pembe savanna later this year.

Conclusion

Abyssinian ground hornbill chick rearing has been a success at Disney's Animal Kingdom Lodge both when chicks are reared entirely by their dam and when the dam is assisted by keeper staff. We feel like we accomplished both of our 2014 goals in the rearing of our second chick, Franz. By leaving him with his brother and dam he was able to observe natural hornbill behaviors from day 1 and learned to socialize with conspecifics. While some imprinting on the keeper team is apparent, Franz displays more natural AGH behaviors than our three hand-raised birds. Overall, the time the keeper team spent to rear Franz with Hanz and Haya was minimal. The team was already spending a few minutes prepping Haya and Hanz's diets at each feed, so they multi-tasked and fed Franz at the same time. Each feed lasted approximately five minutes. The only additional staff hours put in were when a second keeper was required to occupy Haya while Franz was fed. The team utilized this keeper for several months, but looking back has decided that if we hatch two chicks again, this will probably only be necessary for a few weeks. We do acknowledge that each dam is unique and this may not be an option with each pair or female. With such promising results we encourage other keeper teams to consider this rearing method as a preferable alternative to hand-rearing.

Acknowledgements

Many thanks to the entire Disney's Animal Kingdom Lodge Animal Care team, the Avian Research Center team at Disney's Animal Kingdom, DAKL managers: Tommy Jordan and Tim Pinkerton, curator Greg Peccie, and former curator Steve Metzler. Thanks for always encouraging us to think outside the box.

ENRICHMENT OPTIONS

COORDINATORS: Casey Plummer, Caldwell Zoo • Heather Dunn, The Environmental Center Miami, Florida • Julie Hartell-Denardo, St. Louis Zoo • Dawn Neptune, Hogle Zoo

Paper Trial for 1.0 Sumatran Tiger with an Ingestion Behavior

Tyler McCullough, Wild Animal Keeper II
Akron Zoological Park, tylerm@akronzoo.org

1.0 Sumatran Tiger "Sanjiv" on exhibit at Akron Zoological Park. *Photo by Elena Bell*

Introduction

The Akron Zoological Park acquired 1.0 Sumatran Tiger (*Panthera tigris sumatrae*) "Sanjiv" in 2014. On his Animal Data Transfer Form, it was stated that he LOVED phone books, paper mache, and boxes, but that he sometimes ingested paper enrichment items. Unfortunately, this creates potential for an impaction problem if enough of the product is consumed. Upon his arrival we developed a trial to determine: 1) if his favorite enrichment items could still be offered, 2) if identification of specific types of paper or cardboard enrichment that Sanjiv would (and would not) consume was possible, and 3) if there were any scents or spices that were found to increase the likelihood of this ingestion behavior.

Methods

Keepers outlined specific days for each month that Sanjiv was to be given plain cardboard boxes, non-thermal register paper, or newspaper. The results of each interaction were recorded on the Daily Reports to allow the information to be reviewed and compared.

The cardboard was limited to a maximum size of 12"x12"x12". The Zoo's veterinarian determined this amount would be unlikely to cause a significant health problem even if a large percentage of it was ingested by the tiger. The register paper and newspaper were also offered in limited quantities. He also did not receive any part of his regular Nebraska Brand® diet physically combined with these enrichment items. The schedule was set so that Sanjiv only received this type of enrichment on days that he was off-exhibit in the holding area throughout the day, so his response could be closely monitored. This was possible because the zoo houses two male tigers and regularly alternates their exhibit days. Sanjiv was not given overnight access to any paper products for the first several months.

After offering the plain cardboard, register paper, and newspaper, the next step was to offer Sanjiv the above types of products with different scents or spices on them. These included items such as: shipping boxes from fish deliveries, a box that was rubbed on hoofstock hay, a pizza box, a box with cinnamon on it, a box with other "sweet" scents and spices such as nutmeg, vanilla extract, and strawberry perfume, newspaper and register tape with cinnamon and the same "sweet" spices and scents, boxes, newspaper, and register tape with scents from the other male tiger in our collection. The frequency of offerings is shown in Table 1.

If a product was consumed, Sanjiv's pattern of defecation and fecal consistency were monitored more closely for the following few days. Animal management and veterinary staff were notified in this case.

Results and Discussion

After observing Sanjiv's interaction with each type of enrichment, the veterinary staff set guidelines to categorize his consumption level into three categories: No ingestion, small amount of ingestion, and substantial amount of ingestion. "No ingestion" was reported when no consumption was observed. A "small amount of consumption" was determined to be 1% to 59% of the 12"X12"X12" maximum-size box or product. A "substantial amount of consumption" was determined to be 60% to 100% of the box or product. Graph A shows ingestion data.

Using the above guidelines, the following observations were made for this trial:

- No consumption was observed with plain or any scented register paper, plain or any scented newspaper and any paper product with scents from the other tiger in our collection.
- A small amount of consumption was observed with fish shipping boxes and plain boxes, or boxes with "non-sweet" scents and spices on them.
- A substantial amount of consumption was observed with a box with prey scent, a pizza box, and any cardboard boxes with cinnamon on them.
- Both the box with prey scent and the pizza box were only given to Sanjiv one time due to continued risk of ingestion, while a box with cinnamon on it was provided three times to determine if cinnamon was a contributing factor for ingestion in terms of spices provided.

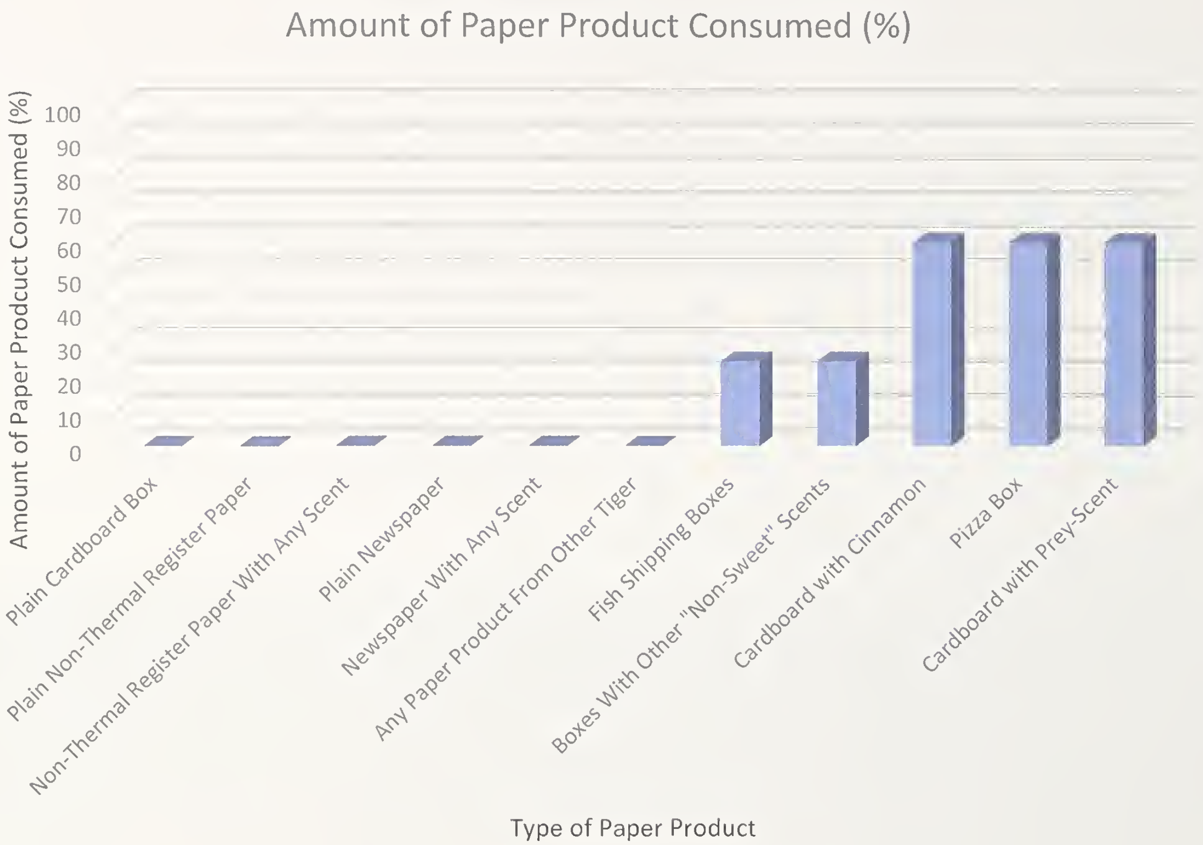
This trial enabled us to achieve the goals outlined in the introduction of this paper. First, Sanjiv is still able to receive the enrichment he enjoys with minimal risk to his health and well-being. Minimal risk to his health was determined by observing that he was properly defecating and did not have impaction problems. A small amount of ingestion (<60%) of the already limited-sized items was considered acceptable. Second, we were able to identify the specific types of paper or cardboard enrichment that Sanjiv would (and would not) consume. Cardboard (12"x12"x12"), register paper and newspaper were all successfully provided without incident. Parameters were set so that if he ingested a substantial amount (>60%) he would be carefully monitored for impaction. If any sign of impaction was evident, the trial was discontinued. Finally, certain scents and spices that were found to increase the incidence of his ingestion behavior (mainly prey animal scent and cinnamon) were removed from use, at least in combination with cardboard.

This trial was also beneficial because it created a model for systematically determining which specific enrichment items could be provided without automatically eliminating every option, especially in the case of paper

Table 1

TYPE OF ENRICHMENT	OFFERINGS (#)
Plain cardboard box	3
Plain non-thermal register paper	3
Non-thermal register paper with prey scent	3
Plain newspaper	3
Newspaper with any scent	3
Any paper product from other Tiger	3
Fish shipping boxes	2
Boxes with other "non-sweet" scents	4
Cardboard with cinnamon	2
Pizza box	1
Cardboard with prey scent	1

Sumatran Tiger "Sanjiv" investigating an enrichment box. *Photo by Elena Bell*



enrichment. It might be tempting to eliminate all paper enrichment options for animals with similar ingestion issues, as zoo staff typically do not want to risk impaction or other potential health issues. The extra time invested in this trial was worth the benefit of now being able to safely offer the tiger favored enrichment items.

In the future, this model will be beneficial in at least two scenarios: A) Providing enrichment to a newly acquired animal without an established enrichment history, and B) when providing new enrichment items, even to animals that have been in the collection long-term. A systematic trial offers the opportunity to closely monitor and record the provision of enrichment items in various forms while assessing their safety.

Acknowledgements
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Editor's Comments
Casey Plummer

Enrichment is often a balancing act of risk and safety, and finding enrichment items that are both effective and 100% safe can be very challenging. So often, our knee-jerk reaction to ingestion of an enrichment item is to ban said enrichment item - after all, we want to keep our animals safe! This paper provides a great alternative – a well-planned, well-documented experiment done with the cooperation of keeper staff, vet staff and management. In this instance, they asked the question “Because this enrichment is highly effective, how much risk is acceptable?” and decided on a reasonable and measurable answer, less than 60% ingestion of an item. Using this standard, they systematically tested the items in small amounts and thoroughly documented the results. This resulted in the accumulation of valuable data with little risk to the tiger, and culminated in the very satisfactory outcome of still allowing the tiger access to effective enrichment items. Kudos to the author and staff who invested the time and effort in this project!

What’s YOUR Zoo’s Enrichment Story? Share with us at bhc@aazk.org!

ATTENTION

To the Professional Membership of the American Association of Zoo Keepers

The Board of Directors is proposing to amend the Bylaws of the Association during the Annual AAZK Conference in Memphis, TN by vote of the professional members in attendance. Per Article VIII, Section 1 - Amendments:

> New Bylaws may be adopted or these Bylaws may be amended or repealed by a majority vote of the eligible voting membership at any Annual Business Meeting or special meeting. Provided the membership has received published notification of the amendments or repeals forty-five (45) days prior to the Annual Business Meeting.

A copy of the proposed revisions is available from the Administrative Offices of the American Association of Zoo Keepers by contacting Ed.Hansen@aazk.org.

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COORDINATORS: Lauren Augustine, Smithsonian's National Zoological Park

Operation Nest Egg (O.N.E.)

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What does Operation Nest Egg (ONE) sound like to you? Could it be a savings account or some sort of secret mission? Well in a way it's both of those things. In the late 1980's it was discovered that kiwi were disappearing at a much higher rate than previously thought. In fact it was downright alarming when the data were analyzed from the field. Kiwi chicks that were hatching in the wild were being predated upon by introduced predators. If left in the field with no pest control in place 90% of kiwi chicks will be predated before they reach six months (mostly by stoats and cats: *Mustela erminca, Felis catus*). Of the remaining 10%, only 5% will reaching 2-years-old (McLennan et al., 1996). Since kiwi are the slowest growing bird species this translates that most will never reach breeding age. Kiwi under 1 kilogram cannot defend themselves whereas birds over that weight can fend off these predators.

Until people showed up about 1000 years ago (the Maori were first) the only mammal species found in New Zealand were three bat species (one is now believed to be extinct) which left the birds, reptiles and invertebrates in New Zealand to flourish in many and diverse ways. The Maori brought both a Polynesian dog and Polynesian rat with them which started the decline of the native species. The Europeans followed in the late 1700's bringing pigs, two more species of rats, cats, weasels, stoats, ferrets, possums and other canine species. All of these predators have thrived upon the native species, one of which is the kiwi.

Several experimental management projects have been carried out to protect kiwi populations under the Bank of New Zealand Kiwi Recovery (this has become the conservation group Kiwis for Kiwi). In the beginning the aims were to increase the productivity and survival through various predator elimination programs (Colbourne et al., 2005). Another part of the recovery program was started in 1994 and involved removing eggs and young chicks from the wild to rear in captivity. This program would not only increase survivorship, but allow kiwi to be moved to areas where the numbers were low or the population was wiped out (providing that first predator control in the area happened first). This program became known as Operation Nest Egg and it is exactly like it sounds. Eggs (and sometimes chicks) are removed from nests in the wild and brought in to captive situations for hatching and rearing and then re-introduction in the wild.

Kiwi young are precocial and are out of the burrow under a week of hatching, and soon afterward they begin to self-feed. They are totally independent (most species) of their parents within a few weeks, making them ideal to deal with in a captive situation as they do not imprint. Although in New Zealand brown kiwi (*Apteryx mantelli*) eggs have been incubated and hatched in zoos since the middle of the last century (sporadically), ONE decided to start by first determining the incubation patterns in the wild rather than using the existing husbandry. The whole aim of ONE was to produce birds for the wild and not for captivity. Part of the research included recording departure, returns or absence of incubating birds, using data loggers, radio-tagged kiwi and video footage; these were all aided by visual inspections of burrows. A dummy egg was created with temperature transmitters (four different sites) and

Top: Prime Minister of New Zealand John Key, Prime Minister of Germany Angela Merkel and a rep. from Kiwis for Kiwi with chick.
Bottom: Ceremony of blessing for the release of a ONE chick

Michele Impey of Kiwis for Kiwi

[illegible] Keepers, Inc.

substituted for real eggs while the male was away from the nest. One of the more interesting facts that came from this research was that contrary to common belief kiwi eggs are turned. All of this information that has been gathered has revolutionized how we artificially incubate kiwi eggs. In 1994 a total of 24 eggs and two young chicks (4 and 22 days old) were collected for the pilot study for ONE. They were all collected from kiwi study sites near Whangarei (North Island) and sent to Wellington Zoo, Department of Conservation (DOC) office in Wellington (with chick rearing at Wellington Zoo, Whangarei Museum and Kiwi House, Kaitaia Nocturnal Park). Ultimately eight chicks were released onto a predator- free island (Motukawanui Island). These birds were joined by two sub-adults that were reared in captivity. All ten birds survived three months. The last transmitters were removed in 1996, and in 2001 two of the 10 birds were recaptured as full-grown adults. These two were re-captured in 2004 (including another original release from 1996). In May 2004 the kiwi population on the island was estimated to be about 50-60 birds (R. Colbourne, S. McManus unpubl. Data).

Not only were the incubation techniques improved by the data collected in ONE but also best practices for retrieval of the eggs; for example when do you remove the egg so as not to disturb the birds and how far along in the incubation is best when to retrieve. Other studies that have taken advantage of ONE have included looking at the transportation techniques and the effects of jarring on the eggs (Potter and Bassett, 2001). Protocols are now in place for field operators when collecting, including what kind of container, what to pack the egg in and temperature guidelines. ONE eggs have come out of the field being transported by helicopter, airplanes, quad bikes, utes and walking. Our understanding of hatching and chick-rearing has also undergone changes over the past years as researchers, keepers and others have contributed knowledge from their experiences.

How does it work? The first step is finding and monitoring breeding pairs of kiwi, and this takes up to 50% of the overall effort and resources. Transmitters are attached to one or both parents (in brown kiwi only the male is monitored) and then you wait. Once they lay, it is important to pick the right time to pull the egg; eggs early on in the incubation period could fail and it is more labor intensive at the rearing facility. If you are too late the chick could have hatched which might mean the parents are less likely to lay another egg thus the population will not increase as quickly. The aim is to get them at least after 25 days and 50 days or more is even better; the hatching success for a 30-day-old egg is 75% and by 70 days it grows to 90%. Technology has helped getting the timing just right; one product is known as the Egg Timer ™, by electronically monitoring breeding adults and when their movement patterns change they can tell they are incubating the egg, workers can then calculate when to retrieve the egg. This saves hours of time spent keeping track of breeding pairs in the field. Another technology that has been developed is the Chick Timer™. This allows workers to pick newly-hatched chicks, which is a great option if there is a risk of disturbing a parent bird who could stomp on the egg (in the other species of kiwi both sexes share incubation, so the eggs are rarely left alone) or if the burrows are too deep to retrieve the egg (great spotted and rowi kiwi are examples).

The next step is transportation from the field to captive rearing facilities. Eggs are transported in special containers which will keep it warm and secure. Chicks are also provided with special containers. The goal is to be at a facility within 12 hours from the nest (chicks can be longer). At arrival the eggs are candled to determine that the embryo is alive and at what stage in development.

After the chick hatches and is about 2-weeks-old they are moved from the captive facility to a kiwi crèche. These are either an island or an area of land with a predator-proof fence surrounding it. Although kiwi do not imprint they have found the chicks have a higher success if they are put into these special areas while they grow up. It also helps cut down disease risk and is less expensive to run than captive rearing facilities. These crèches are found both in the North and South Islands and each one dedicated to one kiwi species; many are funded and set up by local community groups. The crèches run by DOC are mostly on off shore islands. From these crèches (after a certain age and weight, over 1.2KG) they are then transferred back to their original wild home or they may be used to a new site to establish a new population. These chicks are usually welcomed back home by the local iwi in a welcoming ceremony; the public is invited to attend.

Due to the large amount of workers, including many volunteers, that it takes to run this program one can imagine the amount of training that must be in place to ensure that the eggs and chicks are in capable hands. To this end a Kiwi Egg Candling Workshop was developed and now runs once a year at the Kiwi Encounter at Rainbow Springs, Rotorua. Kiwis for Kiwi and DOC underwrite this two day course. Besides teaching incubation techniques for kiwi it also trains people on how to best handle kiwi eggs, everything from the actual removal from a burrow to how to put the egg in a box.

From this small start ONE has grown to involve four of the five species of kiwi (the exception being the little spotted kiwi, *A. owenii*) under the combination of DOC, zoological parks, community kiwi conservation groups, iwi and researchers. This massive undertaking now raises more than 200 chicks yearly. From all of this research several manuals have been produced and the best practices for kiwi in general have all undergone editing to incorporate the new knowledge. Several milestones have been reached since the humble beginning:

- 2002/03 Breeding season: first 3rd generation egg is laid from one of the original ONE chicks hatched at Auckland Zoo
- 2007 Kiwi Encounter hatches its 500th chick, Auckland Zoo its 150th
- 2007 Great spotted kiwi came into the ONE program
- 2008 the 1000th ONE chick hatches
- 2010 ONE chicks are used to established new populations of Haast tokoeka in two areas.
- 2010 20 rowi are released into the Okarito forest to help the existing population. It has helped the rowi population increase by 100%.

ONE has become a very useful tool to help boost kiwi numbers quickly and helps keep other management tools more cost effective. The use of ONE will decrease as the population grows but it does allow some breathing space while the bigger issues of pest control are dealt with. Not to neglect the public face of highlighting the plight that kiwi face daily in the wild, ONE allows the public to see this very secret side of a species that the majority of New Zealanders have never even seen an adult in the wild. There are several kiwi "nurseries" at different institutions throughout New Zealand that the public can visit and see the operation of ONE eggs and chicks before they leave for the wild. As keepers we all know the most valuable tool that we have for educating the public are the animals themselves, and nothing does that better than the young!

References:

Barlow, S. 2011. Captive Management Plan for Kiwi. Zoo and Aquarium Association, New Zealand Branch.

Bassett, S. 2012. Operation Nest Egg Incubation and Chick Rearing Best Practice Protocols. http://www.doc.govt.nz/Documents/conservation/native-animals/birds/operation-nest-egg-protocols.pdf

Colbourne, R., S. Bassett, T. Billing, H. McCormick, J. Mclennan, A. Nelson, and H. Robertson. 2005. The Development of Operation Nest Egg as a Tool in the Conservation Management of Kiwi. Department of Conservation.

Training an Adult Male Western Lowland Gorilla *(Gorilla gorilla gorilla)* for the Voluntary Administration of an Intranasal Spray

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Introduction

Positive reinforcement training (PRT) is a significant contributor to the well being of animals under human care. PRT is primarily utilized to increase the ease with which husbandry and veterinary procedures are conducted, which includes a wide range of behaviors such as voluntary injection (Mueller, 2015), blood and urine collection (Laule et al., 1996), semen collection (Brown and Loskutoff, 1998), and transabdominal ultrasound (Broder et al., 2008). In addition, PRT has been used to address specific behavioral problems including abnormal behavior (Coleman and Maier, 2010), inappropriate maternal behavior (Joines, 1977), aggression among conspecifics (Bloomsmith et al., 1994), and keeper-directed aggression (Savastano et al., 2003).

At Cleveland Metroparks Zoo, a PRT program was initiated with Mokolo, a 28-year-old adult male western lowland gorilla (*Gorilla gorilla gorilla*) as part of an ongoing research project to biologically validate the presence of the neuroendocrine hormone oxytocin in western lowland gorilla saliva and urine. Oxytocin is one of the primary hormonal regulators of affiliation and bonding in mammals. To validate the hormone, observing an increase in relation to baseline levels was needed, and it was determined that an intranasal spray of oxytocin would be the least invasive method of creating such an increase. Once Mokolo was trained to accept the nasal spray, a commercial enzyme immunoassay developed for measuring mammalian oxytocin was used to test the urine and saliva samples collected from Mokolo. Samples were collected prior to the administration to create a baseline profile for Mokolo. Following the administration of the intranasal oxytocin, a rise in oxytocin would be expected, followed by a gradual return to baseline. By correlating a peak in oxytocin measured via enzyme immunoassay with a known event (the intranasal spray), it can be confidently said oxytocin is being measured in gorilla saliva and urine and not another hormone that may interfere with the enzyme immunoassay. Once validated, the measurement of oxytocin in gorilla saliva and urine can be used to assess the quality of the social environment for zoo gorillas, with the goal of providing insight into what management and husbandry factors contribute to the most optimal social environments. With this information it is hoped that the welfare of gorillas in zoos can be improved, furthering the successful management of this population.

Training Overview

Mokolo, was housed as part of a bachelor dyad at Cleveland Metroparks Zoo. Beginning in late March 2015, training sessions occurred three days a week for approximately 5 to 10 minutes in the afternoon. Training sessions occurred while the gorillas were in their indoor exhibit. Beginning in April, the gorillas were provided access to their outdoor enclosure between 1000 and 1700 hrs. Once gorillas were given outdoor access, all sessions occurred in an off-exhibit holding area before gorillas went on exhibit. Mokolo has been successfully trained for the presentation of various body parts for examination, as well as for obtaining voluntary ear temperatures, cardiac ultrasounds and saliva collection. Sessions also included training for voluntary blood draw, and shaping the nasal spray behavior. Austin Leeds (AL) conducted all training sessions for the nasal spray behavior as well as assisting with Mokolo's maintenance behavior training. During most training sessions AL was accompanied by Julie Good (JG), the lead keeper at the Primate, Cat and Aquatics building and one of two primary gorilla keepers. JG provided feedback and suggestions throughout the entire training process.

To administer the nasal spray, a SNOOT! (www.snootspray.com) spray bottle, modified to ensure trainer safety, was used (Figure 1). Two holes were drilled along the squeeze bar and a thin string was tied through one hole and looped back up the second hole to create a spray trigger. A thin piece of plastic tubing (cut from a small plastic pipette) was inserted over the end of the loop to create a firm handle that ensured the squeeze bar was pulled down evenly and sprayed properly. This set up allowed for complete insertion of the device into Mokolo's nostril while preventing the trainer's fingers from crossing the steel mesh barrier.

Initial Training/Familiarization

AL, who previously did not have regular interaction with Mokolo, spent the first two weeks hand feeding Mokolo and working with him on already established body presentations to increase familiarity and trust. In week three, AL began shaping the behavior by having Mokolo present his nose to the mesh. The verbal command "GOOD" was utilized as the bridge and green beans were the primary reinforcement. The use of a traditional buoy target was thought to be too large to position the nose where it was needed, so to shape the behavior the green beans were held up close to the mesh barrier while AL said "NOSE." The green bean was used as a lure taking advantage of the subject placing his face close to the mesh barrier in anticipation of being provided a food reward. Once Mokolo placed his face close to the caging the bridge was used and he was reinforced with his food reward. All of this took place while Mokolo was seated in front of AL with his hands grasping the mesh above his head.

Introducing the Nasal Spray Device

By early May 2015 the training for the presentation of Mokolo's nose was not progressing. Although Mokolo was successfully presenting his nose, the placement was inconsistent, likely due to the green bean acting as a lure and not a target. At this point it was decided to bring in the nasal spray device to use as a target. Using the spray device ultimately was a much more appropriate step as the subject almost immediately began targeting his nose directly where the nasal spray device was placed along the barrier (Figure 2). After several sessions, the verbal cue "NOSE" was all that was needed for Mokolo to present his nose in the appropriate place.

Mokolo was then desensitized to being touched around the nose with the tip of the spray device. When he placed his nose in position, AL lightly touched the device to the

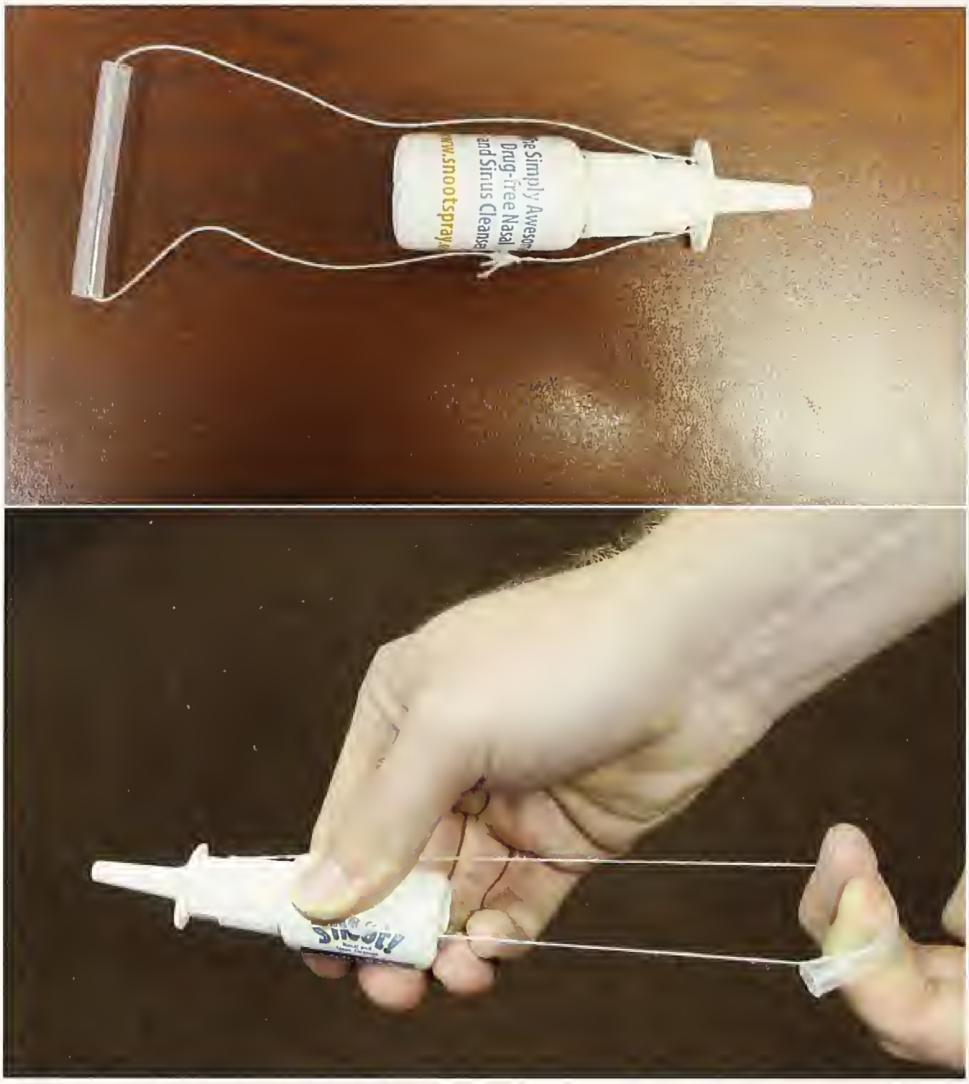

Figure 1. The device used to administer the intranasal spray.

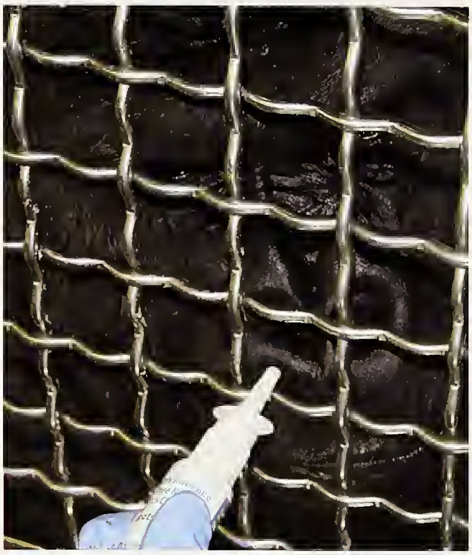

Figure 2. Using the spray device to shap Mokolo's nose placement.

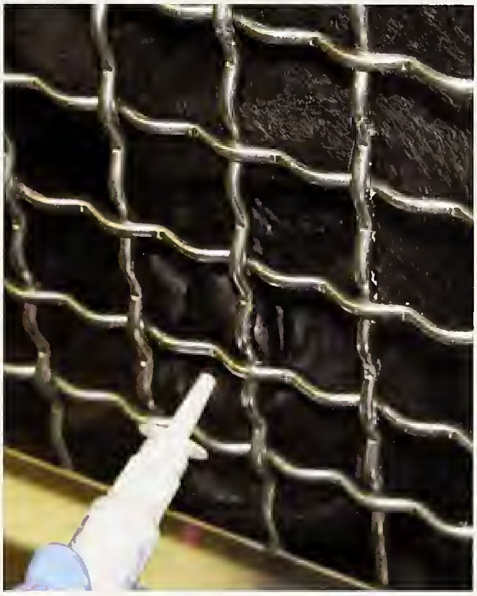

Figure 3. Placing the spray tip at the base of Mokolo's nose.

edge of the nostril. Mokolo did not react to being touched with the device, and after three days, the training progressed to inserting the device into his nostril.

The initial step of inserting the device was to place the tip of the spray device flat against the base of Mokolo's nose (Figure 3). As he became more comfortable, the spray device was then placed further into his nostril, while maintaining contact between the spray tip and the bottom of his nasal cavity. When the spray tip was more than half way inside the nostril he would flare his nostril, pull back, and attempt to bite the spray device.

First Administration of a Saline Spray

Though Mokolo was showing signs he was uncomfortable with the device being inserted deep into his nostril, he was tolerant to the device being placed approximately half way in. This was potentially sufficient to administer an intranasal spray so it was decided to move forward with the first practice saline spray. To prepare, for the next two weeks the device was inserted into Mokolo's nostril and a puff of air was sprayed, accompanied by the verbal command "SPRAY." Mokolo had little reaction to this, which was never more than a flared nostril, with no other movement or change in position.

On June 6, 2015, Mokolo received his first saline intranasal spray, like the sessions before, prior to the spray the verbal cue "SPRAY" was used and after the completion of the spray the bridge "GOOD" was used. To signal that this was a "live" spray, the device was primed in front of him, once in the air, and once aimed at his hand, which was grasping the mesh barrier. Each time the device was primed, the verbal cue "SPRAY" accompanied it. It was also decided that following a "live" intranasal spray, apple and grape would be used as a reward instead of the standard reward of green beans to provide a more desirable reward. This first session was deemed successful in terms of Mokolo's reaction. Following the spray Mokolo jerked his head back but did not leave his seated position and otherwise seemed unphased.

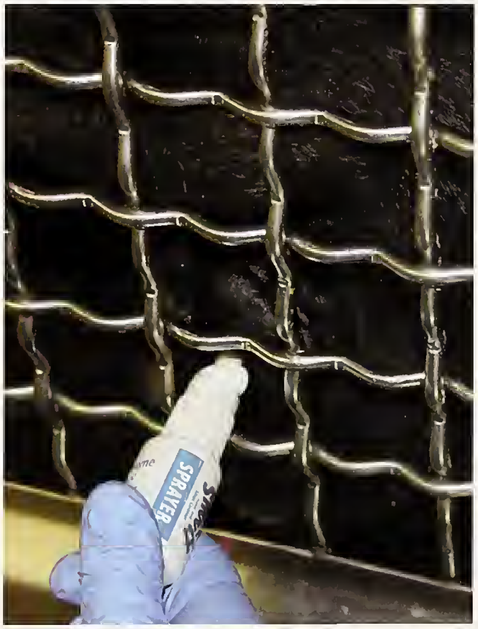

Figure 4. The device fully inserted into Mokolo's nostril.

Unfortunately, the majority of the saline spray did not stay in his nasal cavity and was observed to drip out almost immediately. It was determined that the device would need to be fully inserted into Mokolo's nostril to be effective.

Adjusting and Moving Forward

Keeping contact between the device and Mokolo's nostril was done to ensure that he was aware of where the device was, however he became aversive to this. It was decided to proceed with training for complete insertion without touching the inside of the nostril. Moving to this strategy was almost immediately successful. On the first day Mokolo flared his nostril as the device was inserted, but he did not react any further. Within several training sessions Mokolo allowed for complete insertion of the spray device into his nostril (Figure 4).

The final stage of training was focused on Mokolo alternating the presentation of each nostril. Up to this point Mokolo had been only presenting his left nostril, but the appropriate dose of oxytocin would require two intranasal sprays, one in each nostril. The initial training step was changing the placement of the device for his left nostril. Previously, the device was placed immediately in front of Mokolo. He would lean forward with a slight twist of the neck to present his left nostril. To begin shaping the alternation of each nostril, the placement of the device was exaggerated to the left, requiring him to lean in and twist his neck further presenting only the left nostril. This approach was then replicated for the right nostril. During the first session Mokolo would readjust his sitting position when the device was presented to the right so that he could present his left nostril. To keep him in place or station, a simultaneous "HAND" command was given. This required Mokolo to hold the mesh barrier in the opposite direction in which he was leaning. This kept him from leaving his seated position while leaning and allowed for the presentation of his right nostril. Over several sessions the exaggeration of the placement was decreased until the device was placed directly in front of him with a slight aim at either nostril signaling which nostril was desired for presentation.

Successful Administration of the Nasal Spray

During the first and third week of August 2015, Mokolo participated again in "live" spray sessions. On the first session, only one saline spray was administered. Mokolo's reaction was mild, with a slight jerk of his head but no other change in position or behavior. On August 21, Mokolo was administered two saline intranasal sprays, one in each nostril. The first spray was administered, followed by a reward, with no novel reaction from Mokolo. When asked to present the second nostril, he puckered his lips and began presenting random body parts. The nasal spray device was placed on the floor, and Mokolo was given a few basic hand placement requests and received a reward. The nasal spray device was then picked up again, he was asked for his second nostril, which he presented and the second spray was administered. His reaction to the second spray was similar to the first, with a small jerk of the head but otherwise no movement or change in behavior. Following this session it was deemed that the subject was reliably trained, and the biological validation day, in which Mokolo would be administered intranasal oxytocin, was scheduled. On September 11, 2015, following a week of baseline saliva and urine collection, Mokolo was administered 40IU of oxytocin (Sigma-Aldrich, St Louis, MO) via one spray into each nostril (20IU each nostril). Following the nasal spray, saliva samples were collected at 30 min intervals for 2 hours and urine samples were collected as they were produced over the same 2-hour period. Additional samples were then collected each morning for the following week. The lab work is ongoing to assess if the hormone oxytocin was successfully validated via this procedure.

Conclusion

To the author's knowledge, this is the first time a western lowland gorilla has been trained for the voluntary administration of an intranasal spray. While there is no immediate need for the subject to continue intranasal training, it is the hope in sharing this article that other zoos may be able to benefit from the training in which Mokolo participated. The development of intranasal drugs is becoming increasingly popular by manufacturers and may be potentially less invasive than traditional intramuscular or intravenous injections (Costantino et al., 2007). For example, diabetes is common in zoo primates (Kuhar et al., 2013) however, training animals for multiple daily injections can present challenges (Stone et al., 2010). Intranasal insulin, which is currently being used in various contexts for humans, may have applications for diabetic zoo animals. Intranasal flu vaccines and allergy medicines also are becoming more popular, as well as treatments for pain management. All of which have potential applications in zoos, especially for animals that avoid pills hidden in food or who are aversive to needles.

This paper was presented at the 2015 Southeast Regional Gorilla Workshop.

References

Bloomsmith, M.A., G.E. Laule, P.L. Alford, and R.H. Thurston. 1994. Using training to moderate chimpanzee aggression during feeding. *Zoo Biology* 13:557-566.

Broder, J.M., A.J. MacFadden, L.M. Cosens, D.S. Rosenstein, and T.M. Harrison. 2008. Use of positive reinforcement conditioning to monitor pregnancy in an unanesthetized snow leopard (*Uncia uncia*) via transabdominal ultrasound. *Zoo Biology* 27:78-85.

Brown, C.S., and N.M. Loskutoff. 1998. A training program for noninvasive semen collection in captive western lowland gorillas (*Gorilla gorilla gorilla*). *Zoo Biology* 17:143-151.

Coleman, K., and A. Maier. 2010. The use of positive reinforcement training to reduce stereotypic behavior in rhesus macaques. *Applied Animal Behaviour Science* 124:142-148.

Costantino, H.R., L. Illum, G. Brandt, P.H. Johnson, and S.C. Quay. 2007. Intranasal delivery: physicochemical and therapeutic aspects. *International Journal of Pharmaceutics* 337:1-24.

Kuhar, C.W., G.A. Fuller, and P.M. Dennis. 2013. A survey of diabetes prevalence in zoo-housed primates. *Zoo Biology* 32:63-69.

Joines, S. 1977. A training programme designed to induce maternal behaviour in a multiparous female Lowland gorilla, *Gorilla g. gorilla*, at the San Diego Wild Animal Park. *International Zoo Yearbook* 17:185-188.

Laule, G.E., R.H. Thurston, P.L. Alford, and M.A. Bloomsmith. 1996. Training to reliably obtain blood and urine samples from a diabetic chimpanzee (*Pan troglodytes*). *Zoo Biology* 15:587-591.

Mueller, C. 2015. Injection training with an Andean bear (*Tremarctos ornatus*) pair in quarantine. *Animal Keepers' Forum* 42:184 -187.

Savastano, G., A. Hanson, and C. McCann. 2003. The development of an operant conditioning training program for New World primates at the Bronx Zoo. *Journal of Applied Animal Welfare Science* 6:247-261.

Stone, D., J. Wark, and P. Dennis. 2010. Management of a diabetic golden-bellied mangabey (*Cercocebus chrysogaster*). *Animal Keepers' Forum* 39:504-508.

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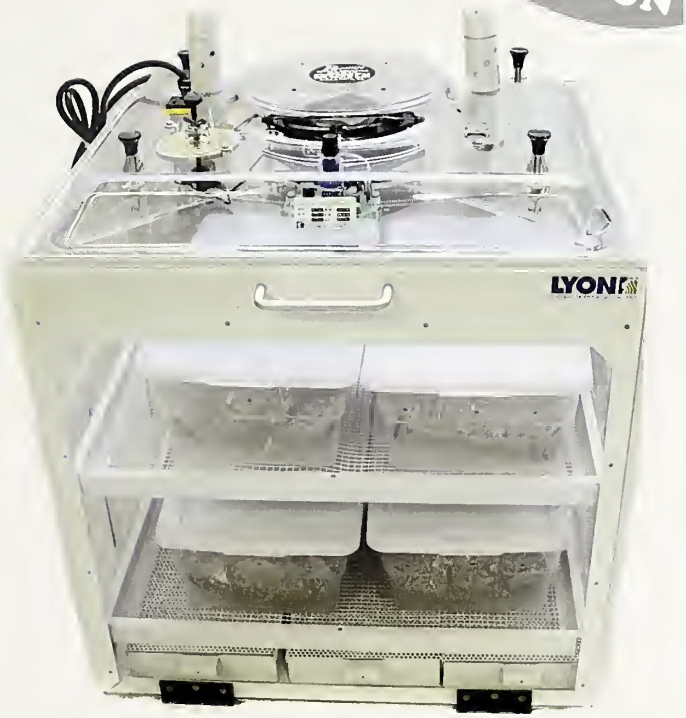

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